

What is claimed is:

1. A film-forming surface reforming method comprising the steps of:

5 bringing a gas or an aqueous solution containing any one selected from the group consisting of ammonia, hydrazine, amine, amino compound, and their derivative into contact with a film-forming surface before an insulating film is formed on the film-forming surface of a substrate; and

10 bringing a gas or an aqueous solution containing any one selected from the group consisting of hydrogen peroxide, ozone, oxygen, nitric acid, sulfuric acid, and their derivative into contact with the film-forming surface.

15 2. A film-forming surface reforming method according to claim 1, wherein any one of a silicon oxide film and a silicon nitride film is exposed on the film-forming surface.

20 3. A film-forming surface reforming method according to claim 2, wherein any one of a semiconductor layer and a metal layer in addition to any one of the silicon oxide film and the silicon nitride film is exposed on the film-forming surface.

25 4. A film-forming surface reforming method according to claim 1, wherein the amine is a compound having a chemical formula NR_nH_{3-n} ($n=1,2,3$, R: alkyl group).

5. A film-forming surface reforming method according to claim 1, wherein the amino compound is a compound having a chemical formula RNH_2 (R: organic group).

5 6. A semiconductor device manufacturing method
comprising the steps of:

bringing a gas or an aqueous solution containing any one selected from the group consisting of ammonia, hydrazine, amine, amino compound, and their derivative
10 into contact with a film-forming surface before an insulating film is formed on the film-forming surface of a substrate;

reforming the film-forming surface by bringing a gas or an aqueous solution containing any one selected from the group consisting of hydrogen peroxide, ozone, oxygen, nitric acid, sulfuric acid, and their derivative into contact with the film-forming surface; and

forming an insulating film on the reformed film-
20 forming surface.

7. A semiconductor device manufacturing method comprising the steps of:

exposing a film-forming surface of a silicon nitride film to a hydrogen peroxide water; and

25 forming an insulating film on the film-forming
surface after the film-forming surface is exposed to
the hydrogen peroxide water.

8. A semiconductor device manufacturing method comprising the steps of:

exposing a film-forming surface of a silicon oxide film to an aqueous solution containing any one
5 of NO_2^- and NO_3^- ; and

forming an insulating film on the film-forming surface after the film-forming surface is exposed to the aqueous solution.

9. A semiconductor device manufacturing method
10 according to claim 8, wherein a mixed solution containing an ammonia (NH_3), a hydrogen peroxide (H_2O_2), and a pure water (H_2O) is employed as the aqueous solution.

10. A semiconductor device manufacturing method
15 according to claim 8, wherein a nitric acid (HNO_3) is added to the aqueous solution.

11. A semiconductor device manufacturing method comprising the steps of:

preparing a mixed solution containing an ammonia
20 (NH_3), a hydrogen peroxide (H_2O_2), and a pure water (H_2O);

heat-insulating the mixed solution at a predetermined temperature for a predetermined time so that NO_2^- and NO_3^- concentrations in the mixed solution
25 are set to a desired concentration;

exposing a film-forming surface of a silicon oxide film to the mixed solution after the heat-

insulating; and

forming an insulating film on the film-forming surface after the film-forming surface is exposed to the mixed solution.

- 5 12. A semiconductor device manufacturing method according to any one of claims 6, 7, 8, and 11, wherein the insulating film is a silicon-containing insulating film which is formed by a thermal chemical vapor deposition employing a reaction gas that
- 10 contains an ozone-containing gas and a tetraethylorthosilicate.

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